Mapping the Invisible:
The Role of Geospatial Technology to Survey Urban Internally Displaced Persons

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Tufts

NORWEGIAN REFUGEE COUNCIL

Feinstein International Center

iDMC Internal displacement monitoring centre

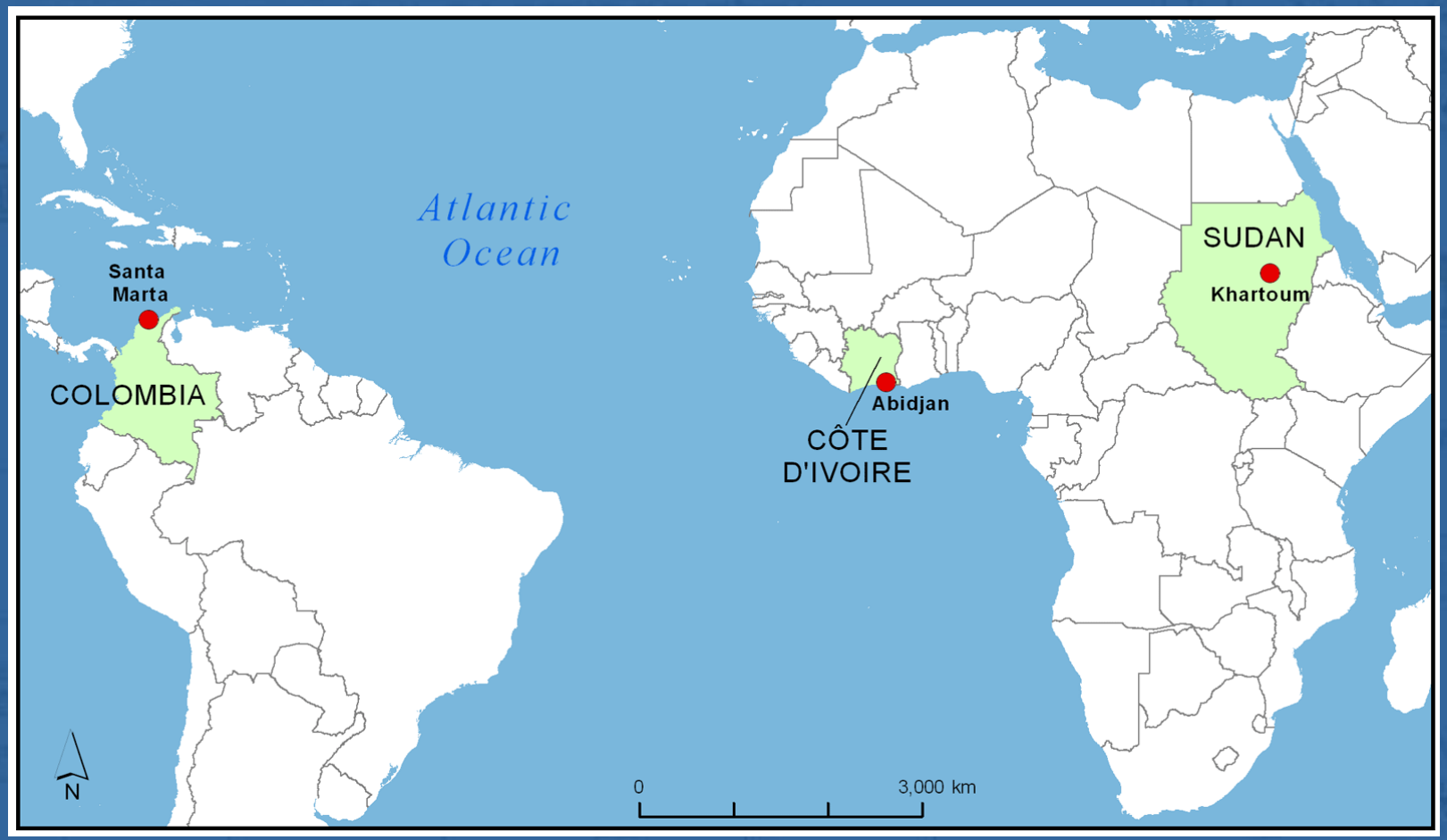
Overview

- Goal
  - Develop techniques to gather information on urban internally displaced persons (IDPs)
- Project Director
  - Dr. Karen Jacobsen, Feinstein International Center, Tufts University
  - Internal Displacement Monitoring Centre (IDMC)
- Partner
  - GIS Center, Tufts University

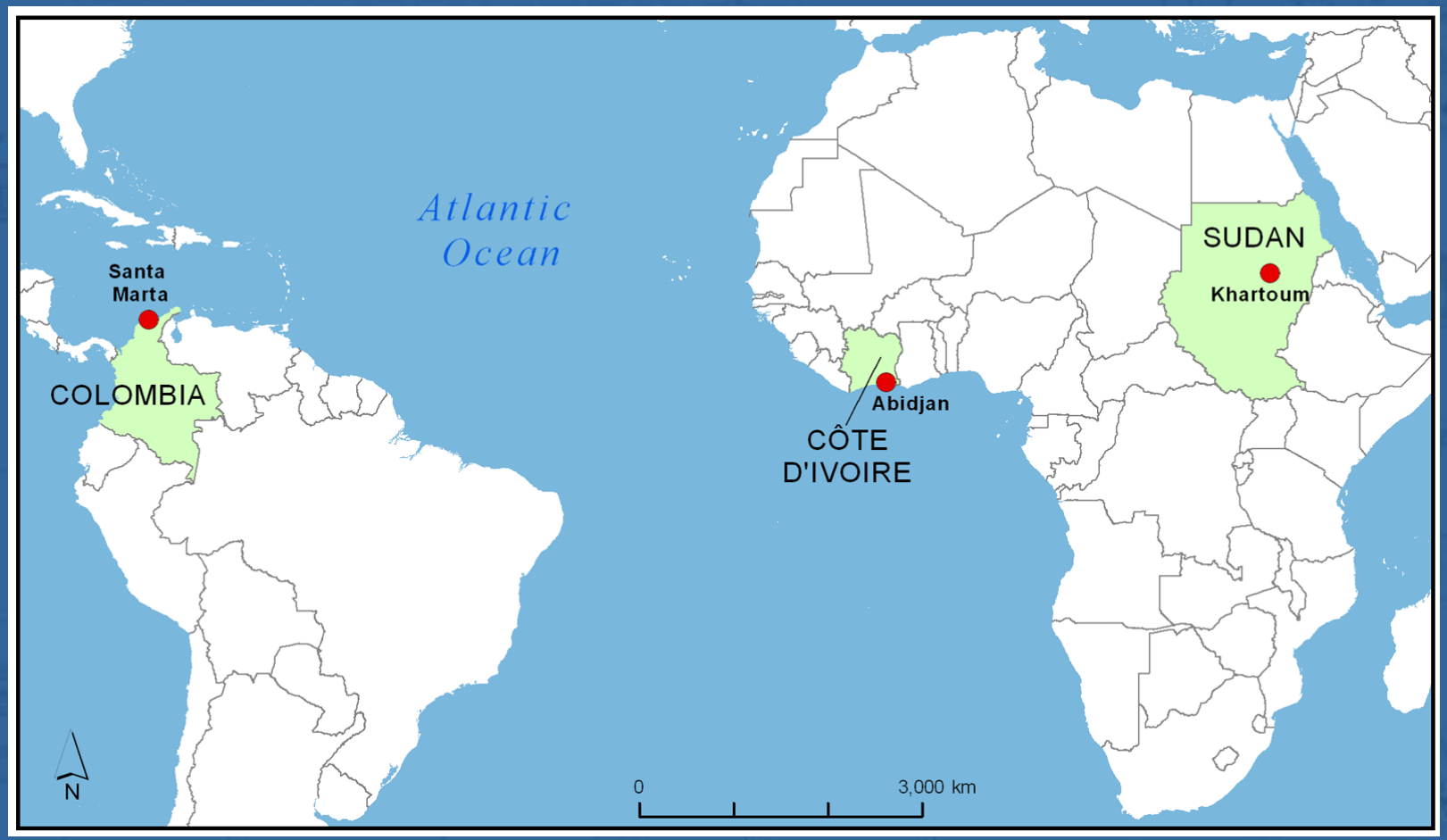
Internally Displaced Person

"Persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border" (IDMC)

- Khartoum, Sudan (January 2007)
- Abidjan, Côte d'Ivoire (May 2007)
- Santa Marta, Colombia (February 2008)



- Abidjan, Côte d'Ivoire (May 2007)
- Santa Marta, Colombia (February 2008)
- Our techniques improved with each successive survey



Primary Objectives

- Develop a methodology that would allow us to make population estimates of IDPs within the defined urban area
- Enable a comparison of the demographic and livelihood characteristics of IDPs and Non-IDPs

Method

- Conducted a detailed household survey using a questionnaire
- Conducted by trained local researchers in the official language of the countries
- Survey Staff
  - 1 project manager
  - 2 supervisor: 1 for each team
  - 2 teams composed of 5 enumerators (10 people)
- 2-3 week period

Why is it Important to Survey IDPs?

- Enormous stress on a city's infrastructure and resources
  - Local→Municipal→State→National→Regional
- Resource allocation
  - How many IDPs are there?
  - Where are the IDPs?
  - Who are they?

Use of Geospatial Technology

- GIS
- GPS
- Remote sensing
- Cartography
- Virtual globe software – Google Earth
- Printed maps
- Database management system (DBMS)

Use of Geospatial Technology

- Strategic Planning
  - Data acquisition
  - Data modeling & design
  - Sampling strategy
- Tactical planning for field data collection
  - Determine selected enumeration to survey each day
  - Plan travel to survey locations
  - Record the location of the survey respondents
- Analysis

The Geospatial Questions

- Where do we go within a city to survey IDPs?
- How do we get there?
- How do we record the locations of survey respondents?
- Where are the IDPs from?

Challenges

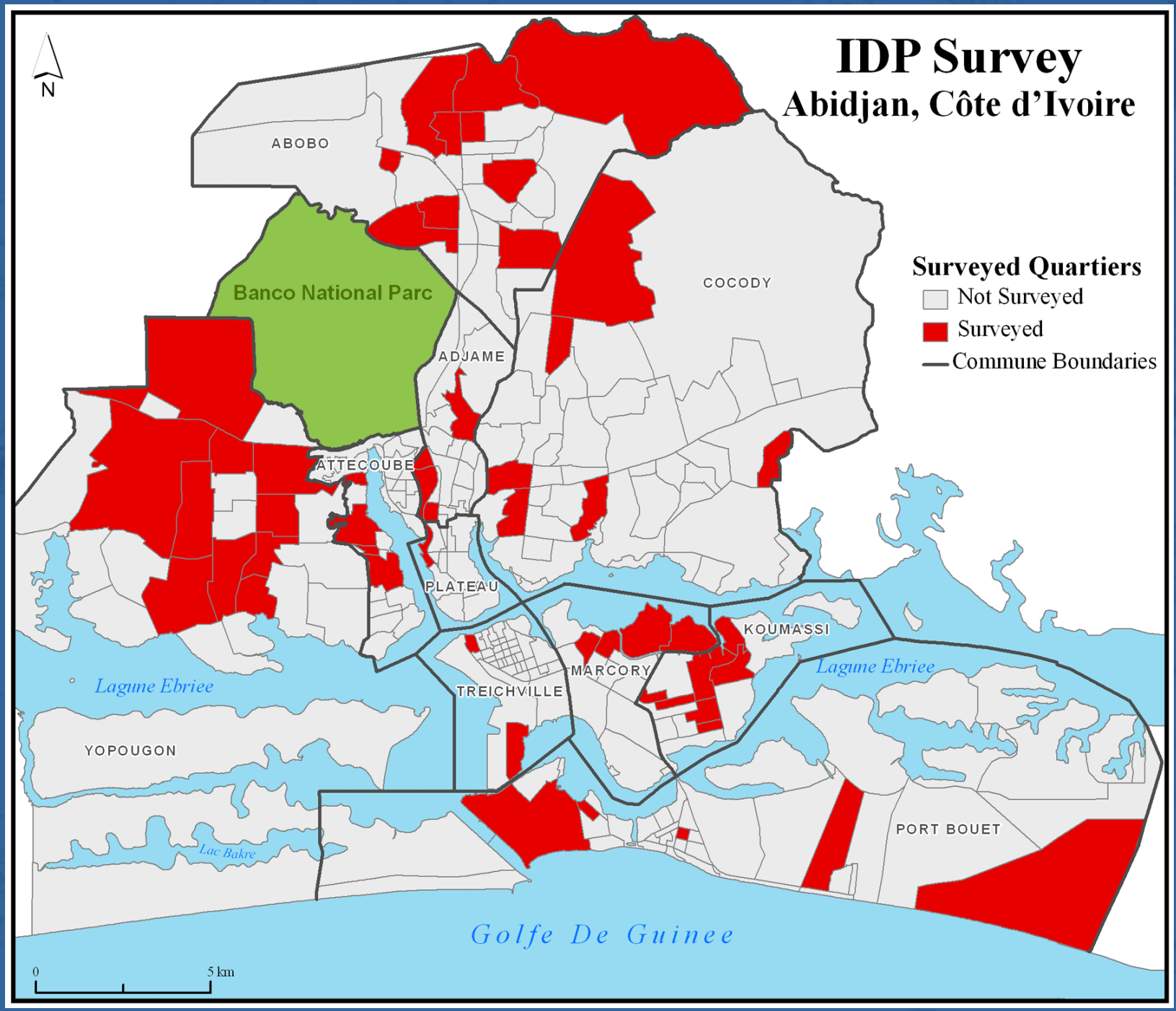
- Logistics
  - Navigating urban terrain can be difficult
  - Maps often do not exist or are incompletes
  - Streets are unmarked
  - Winding dirt roads of shanty towns disorienting
- Unavailability of GIS data
- Locating the invisible
  - Urban IDPs live alongside the urban poor and economic migrants and intentionally seek anonymity for security reasons
- Lack of spatial information literacy among aid workers

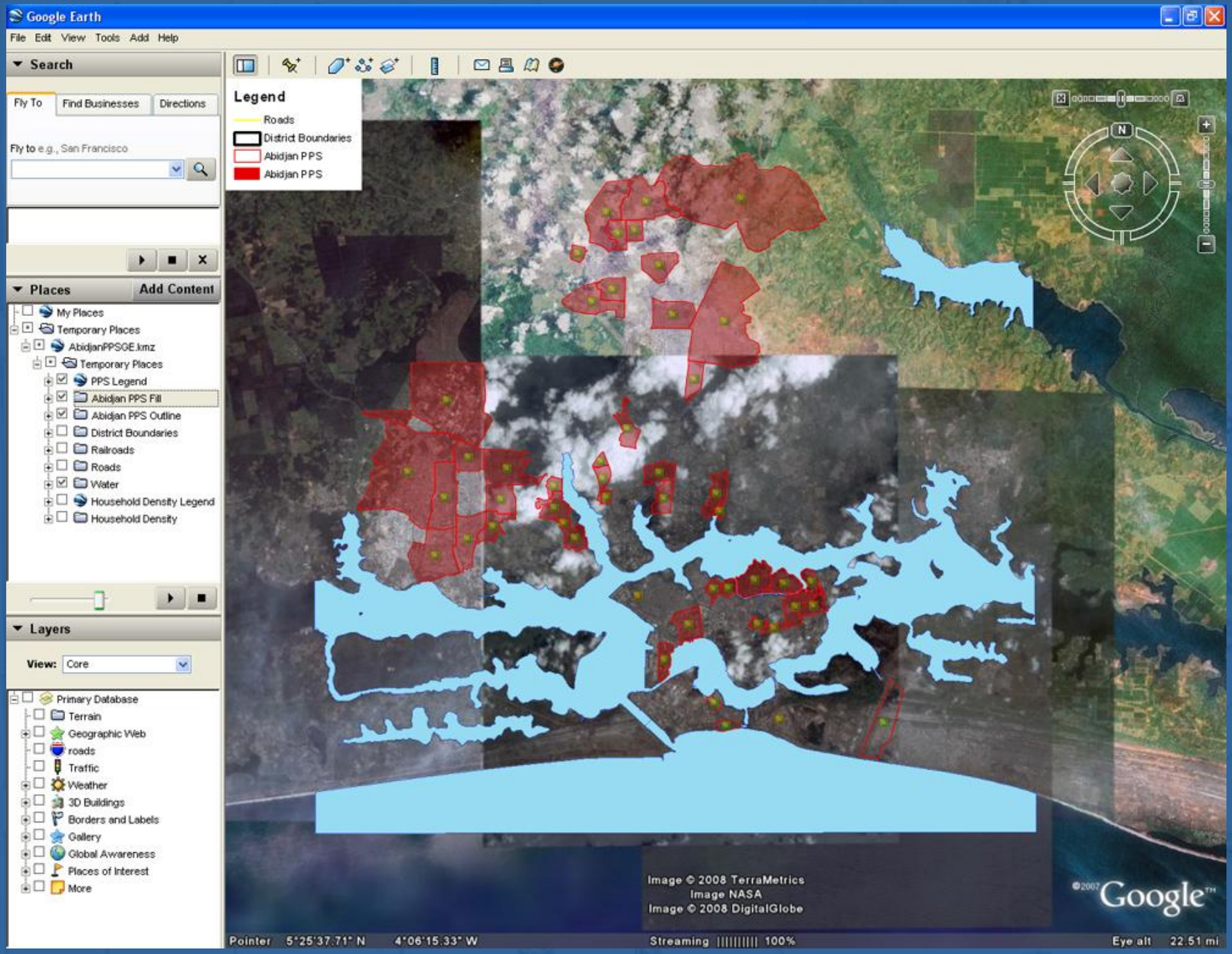
Data Acquisition

Spatial Data	Extent	Source
Quartier boundaries	Abidjan	Digitized and derived from Institut National de la Statistique (INS) map
Commune boundaries	Abidjan	UNOSAT
Streets	Abidjan	UNOSAT
Hydrography	Abidjan	UNOSAT
Quickbird imagery	Abidjan	DigitalGlobe via Google Earth
Barrio boundaries	Santa Marta	Geobis International
Streets	Santa Marta	Geobis International
Hydrography	Santa Marta	Geobis International
Quickbird imagery	Santa Marta	DigitalGlobe via Google Earth
Municipios boundaries	Colombia	DANE via GIST
Departamentos boundaries	Colombia	DANE via GIST

Where do we go in the cities to survey IDPs? 2 Stage Sampling Strategy

- Stage 1
  - Use the enumeration areas with joined census data to select areas for sampling - PPS (Probability Proportional to Size).
    - Weight the sampling by heavy IDP areas
    - Have local aid workers review the selected sampling areas and rank predicted IDP density


IDP Survey
Abidjan, Côte d'Ivoire
N
ABOBO
COCODY
Banco National Parc
ADJAME
ATTECOUBE
PLATEAU
KOUMASSI
MARCORY
TREICHVILLE
YOPOUGON
PORT BOUET
Lagune Ebriee
Lagune Ebriee
Lac Bakre
Golfe De Guinee
Surveyed Quartiers
Not Surveyed
Surveyed
Commune Boundaries
0
5 km



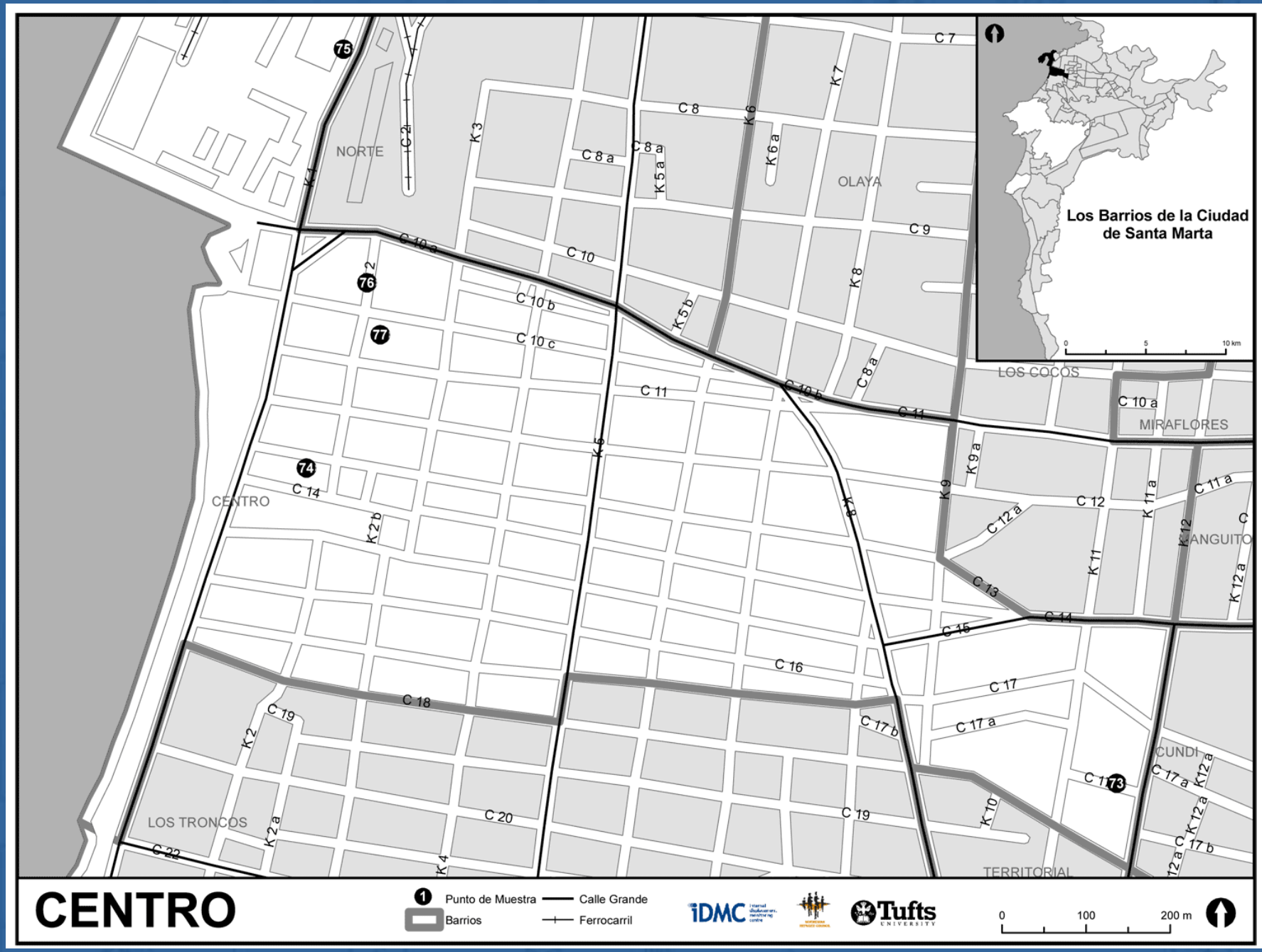
Selected *quartiers* in Google Earth for review by local Abidjan aid workers

Google Earth

- Almost every aid worker knew how to use it
- Took about 5 minutes to learn
- Free
- Allowed free use of high resolution Quickbird imagery for simple overlays
- Allowed aid workers interact with the data
- Fast and Fun

Where do we go in the cities to survey IDPs? 2 Stage Sampling Strategy

- Stage 2
  - For each selected enumeration area we generated 5 random sample points
  - The enumerator went to each random point and and randomly survey from 3-5 households

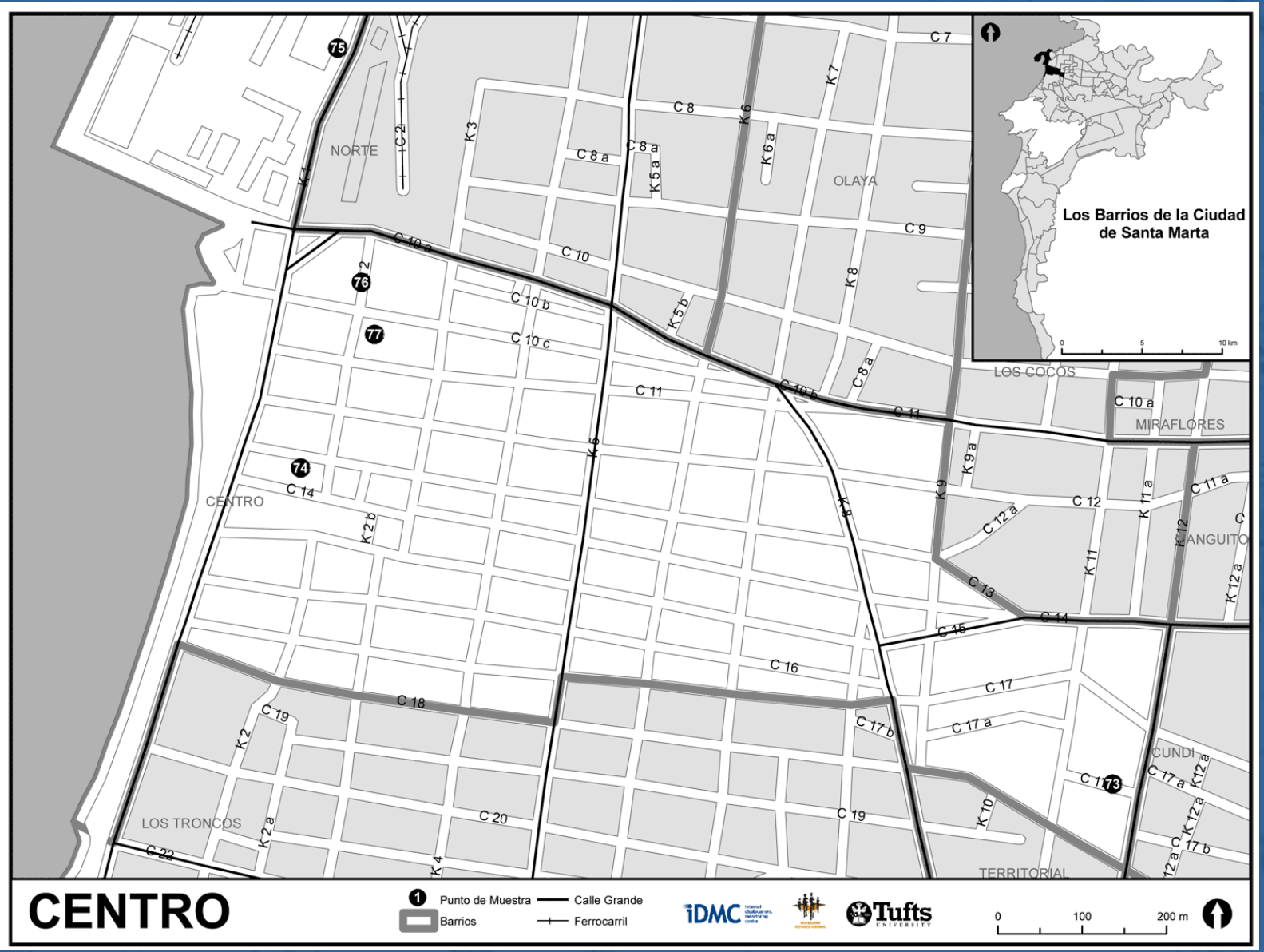


Map of Centro barrio (enumeration area) in Santa Marta depicting random sample points

How Do We Get There?

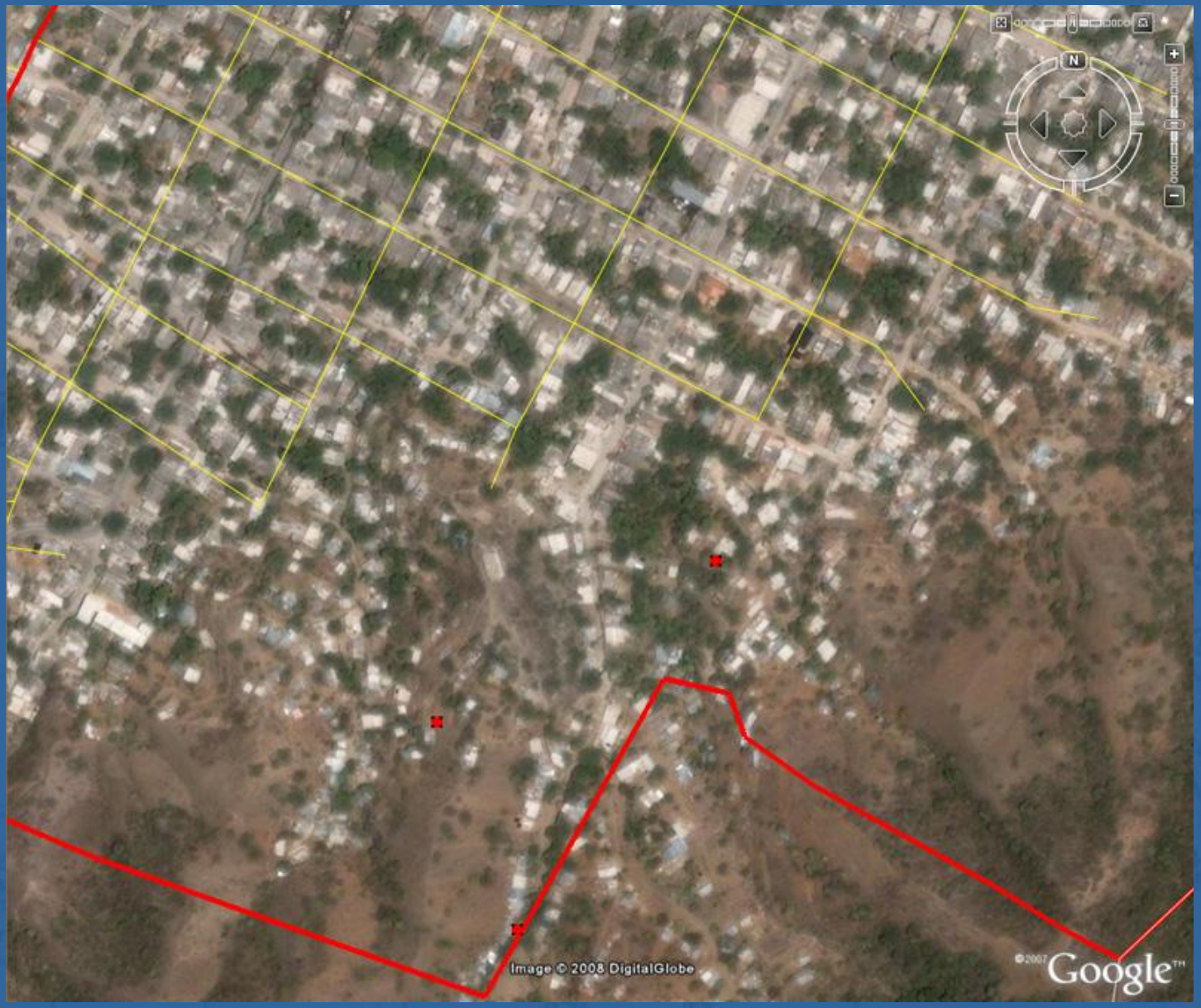
- 30 minutes of map planning every morning
- Created daily custom maps of each enumeration area
  - Required map use/map reading training
- Developed custom Google Earth application
  - Much of mapping data was incomplete or missing, particularly in high IDP areas such as shanty towns.
  - Loaded our sample points, enumeration areas, streets, and hydrographic data in for reference.

Daily Custom Maps



Map of Centro barrio (enumeration area) in Santa Marta depicting random sample points

Custom Google Earth Application



"Off-the-map-area" in Santa Marta with streets (yellow), random sample points (red), and barrio boundaries (red) in Google Earth

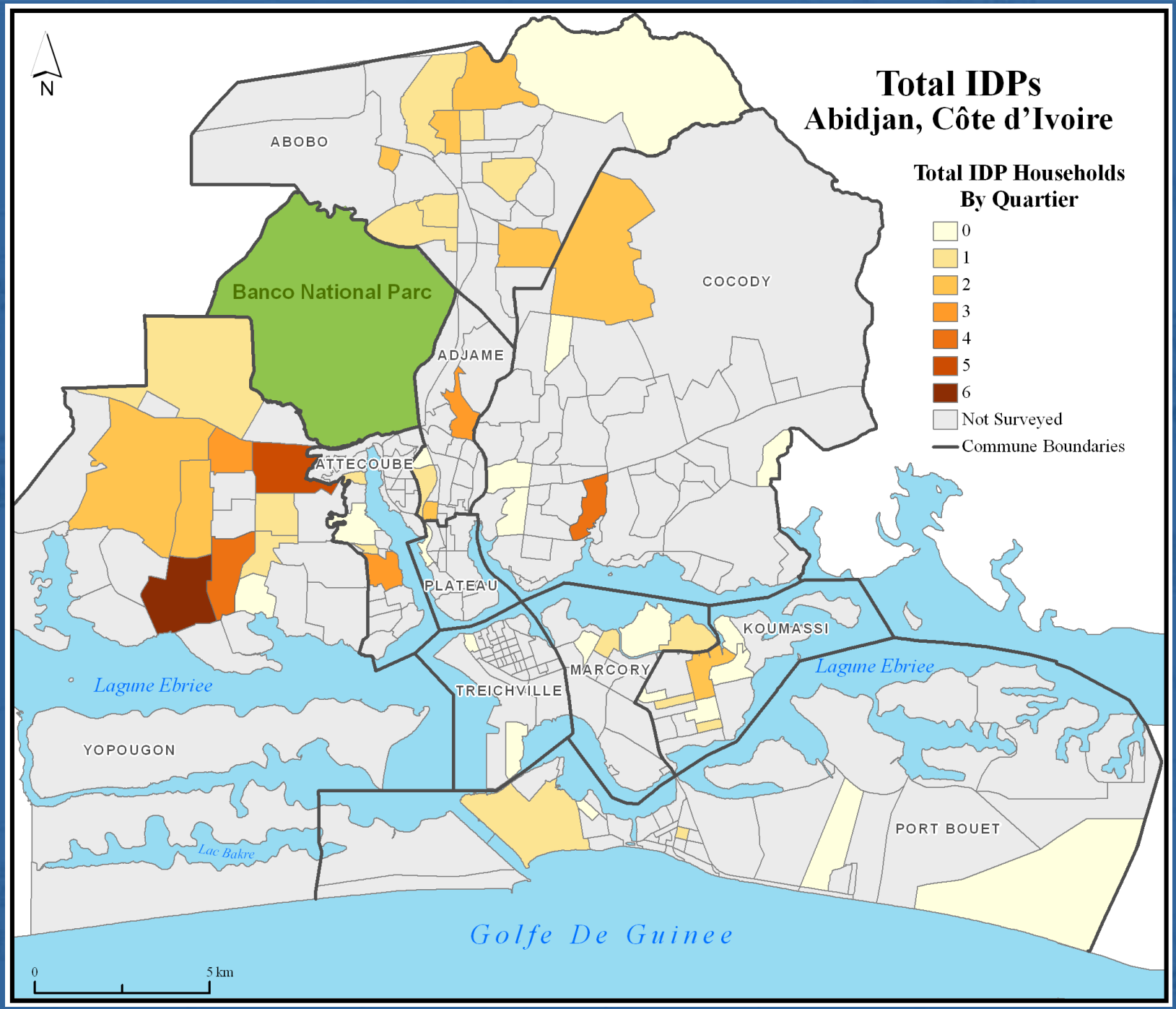
Custom Google Earth Application

"Off-the-map-area" in Abidjan with streets (yellow) in Google Earth

How do we record the locations of Survey Respondents?

- Record enumeration area number
  - Abidjan: *quartier*
  - Santa Marta: *barrio*
  - *Can be difficult to know what enumeration area one is in*
- Record GPS information
  - GPS unit number
  - Waypoint number
  - Long/Lat in decimal degrees

Can compare two techniques to help with quality control



Map of IDPs identified in Abidjan by *quartier*

GPS

- Easy: 45 minutes of training
- Save time and money
- Use handhelds
  - Inexpensive
    - Lost, stolen, or damaged
    - Do not put enumerator at risk
  - Simple
  - Accuracy is good enough

Where are They From?

Location of the origin of the survey respondent

- Where in the country they came from
- Populate database with a look up table of gazetteer or municipal or districts data directly from the GIS data – Place Codes - PCODES
- Establishes Referential Integrity

Do not use free data entry!

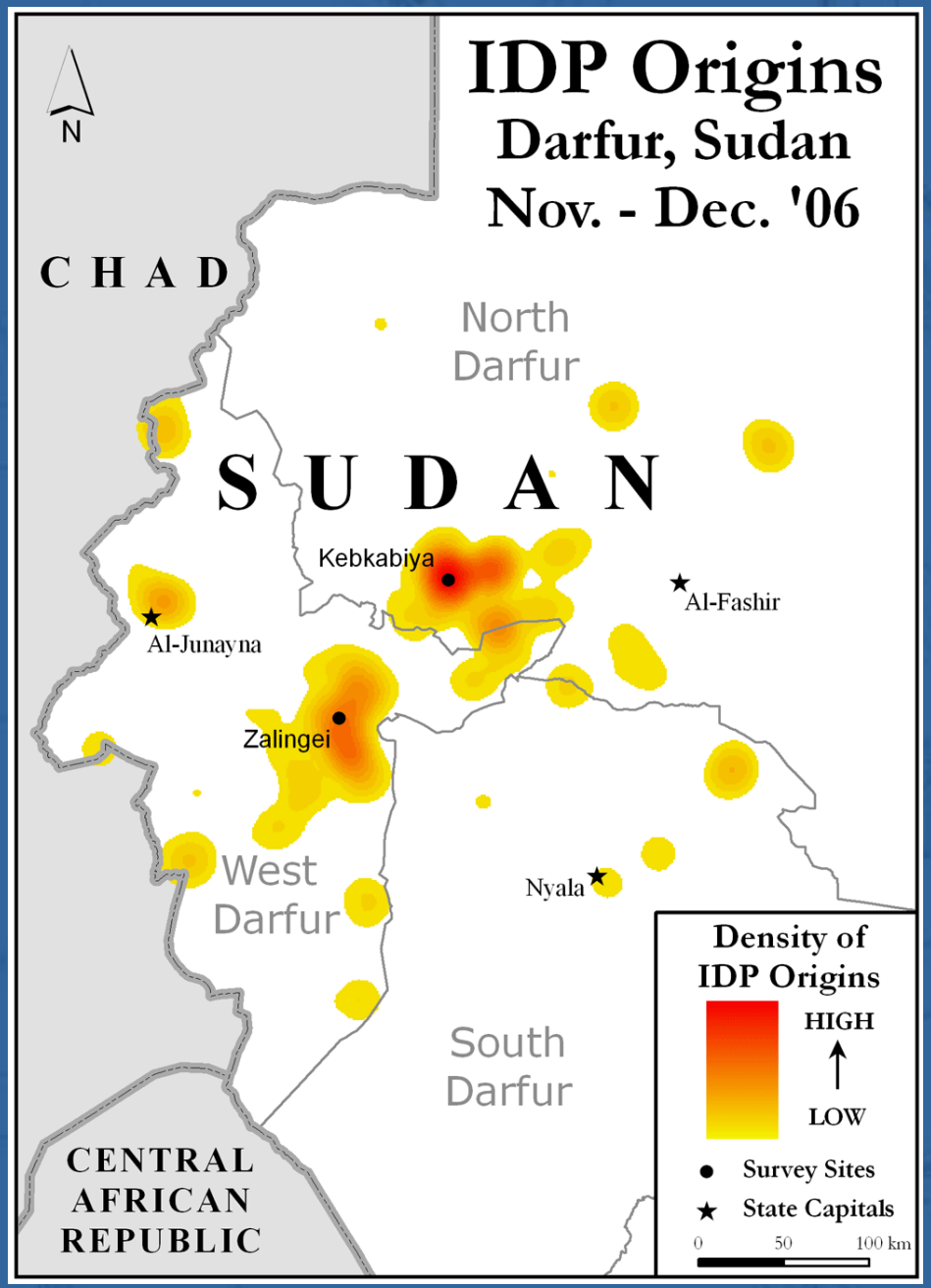
- **The variant spellings due to language and regional differences will render the data useless**
- **Duplicate place names**

LA GUAJIRA	44		
Municipio	**Código**	**Municipio**	**Código**
Barrancas	078	Fonseca	279
Dibulla	090	Hatonuevo	378
Distraccion	098	La Jagua del Pilar	420
El Molino	110	Maicao	430

MAGDALENA	47		
Municipio	**Código**	**Municipio**	**Código**
Algarrobo	030	El Banco	245
Aracataca	053	El Pinon	258
Ariguani	058	El Reten	268
Cerro San Antonio	161	Fundacion	288
Chivolo	170	Guamal	318
Cienaga	980	Pedraza	541

Survey questionnaire look up table of Colombian municipios and departementos

Overview of Darfur IDP survey area



Darfur IDP survey results

The Questions

- Where do we go within a city to survey IDPs?
- How do we get there?
- How do we record the locations of IDPs?
- Where are they from?

Results

- Spatially referenced population surveys with a wealth of socio-economic data
- Abidjan: IDP estimate 299,937 – 440,414
  - Over a period of 6 years
- Most IDPS live in the communes of Yopougon and Abobo
- Ethnicity of IDPs
  - Highest proportion are Baoule and Guere
- Not much difference between IDP and the urban poor

Obstacles to Using Geospatial Technology to Survey Urban IDPs

- Global & National Spatial Data Infrastructure
  - Lack of relevant and accurate baseline data
  - Lack of data sharing
  - Poor communication/coordination between agencies
  - Lack of metadata
  - Time, cost, and difficulty of data development in the field
- Organization structure – independent organizations responding to need
- Lack of Spatial information literacy
- Lack of understanding of data modeling with humanitarian community

Future Work

- Analysis
- Explore interpolation and spatial distribution of IDP populations throughout the non-surveyed areas with the cities.
- Explore automated urban feature extraction from high resolution satellite imagery
- Publish Data
- Publish a recommended data model for IDP surveys
- Conduct workshops

The Study Team

IDMC

- Initial project development: Tone Faret
- Project Management Arild Birkenes, Country Analyst

Feinstein International Center, Tufts University

- Research Director Karen Jacobsen, Ph.D.
- Research Assistants: Anastasia Marshak
- Sarah Krueger
- Kimberly Howe

GIS Center, Academic Technology, UIT, Tufts University

- Senior GIS Specialist: Patrick Florance
- GIS Technicians: Armando Milou
- William Smith
- Bradley Rawson

Implementing Team in Khartoum

- Field supervision: Mohamed Elamin Abd el Gadir (Partners in Development Services)
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Implementing Team in Abidjan

- Field Supervision Eric Levron, consultant

Implementing Team in Santa Marta

- Field Supervision Eric Levron, consultant

Questions? Comments?

http://gis.tufts.edu

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